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METEOROLOGICAL BIBLIOGRAPHY.

WE think that it will be of general interest to state what progress has been made by the United States Signal Office with the preparation of the catalogue of books and papers upon Meteorology.

The articles upon the subject which have appeared in this Magazine* have described Mr. Symons's share in the work, and render it unnecessary to do more than give the references to them for the use of any one who desires to refer to the early history of the subject.

With the permission of General Hazen we proceed to explain the progress which has subsequently been made at the Signal Office, and through his influence.

First and most important of all, Dr. Hellmann has consented to the incorporation of all the works (about 5,200) quoted in his splendid *Repertorium*.

Dr. Hann is preparing a catalogue of the library of the central Anstalt at Vienna.

Prof. Wild forwarded a catalogue of 280, and Prof. Woeikof one of 310, contributions to meteorology.

Dr. Mohn has furnished a similar list for Norway.

A valuable collection of 196 titles has been received from the Royal Library, Copenhagen.

Polish literature will be represented by titles extracted from Zebrawski's *Bibliografia*, Krakau, 1873, completed by titles furnished by Dr. Karlinski.

Senor Merino, of the Madrid Observatory, has kindly undertaken to collect Spanish material.

Dr. J. C. de Brito Capello, of the Lisbon Observatory, has rendered important help.

Dr. Neumayer has furnished a catalogue of the library of the Deutsche-Seewarte, including the important library of Prof. Dove.

Mr. Ellery forwarded a complete bibliography of Victorian Meteorological publications.

Mr. C. Amnerstedt, Librarian of the Upsala University Library,

* Vol. XVII. (1882), p. 1 and 129; Vol. XVIII. (1883), p. 97 and 135.

sent 337 Swedish titles of dates earlier than those published by Fineman.

In completion of the Royal Society Catalogue, the most important periodicals have been indexed from 1874, and 5,000 new titles have already been obtained from this source. Reuss's *Repertorium Commentationum* (about 2,500 titles) has been copied; also Poggendorff's *Handwörterbuch* (about 1,000), Dähuert's *Greifswald Catalogue*, the Royal Society *General Science Catalogue*, Zuchold's *Bibliotheca-Naturalis*, May's *Bibliography of Electricity*, and many others.

The total number of titles now in the office is about 48,000, and although these doubtless contain some duplicates, it must, on the other hand, be recollected that as the catalogue is to be a *subject* ca ogue, many books must be entered twice.

When it is remembered that the Catalogue of the Library of the Royal Meteorological Society (1876) contained only 1,214 entries, one gets an approximate idea of what a great work the Washington Catalogue will be with about forty times that number.

We understand that although the collecting is almost finished, and the classification has been commenced, there is still time for the reception of additional material if any of our readers have fresh titles to send, because Congress has not yet voted the funds for publication. We, however, refuse to believe for a moment that Congress will in this respect depart from the generous views which it has always held respecting the diffusion of useful knowledge.

THE BIELA METEORS.

ON or about November the 18th, the following circular was issued from Lord Crawford's Observatory, Dun Echt, Aberdeenshire:—

"Considering the great uncertainty which envelopes the fate of Biela's comet, it seems desirable to call to mind that about midnight on the 27th inst. the earth will be in the path of the meteors seen to radiate from near γ Andromedæ on November 22, 1872. The comet's periodic time, and presumably that of the meteors, being about 6·6 years, nearly two periods will have elapsed since the meteoric shower of 1872. If, therefore, the meteors are very widely distributed along the comet's orbit, there is a chance that they may again appear in considerable numbers this year. In 1892, and still more in 1905, there is a probability of a return of the display of 1872."

As regards the complete fulfilment of this anticipation, we print *in extenso* two notes with which we have been favoured, and at the end of them an epitome of such other information as has come to hand.

To the Editor of the Meteorological Magazine.

SIR,—The display to which attention was drawn by circular from Dun Echt took place on the 27th, but earlier in the evening than was anticipated. It commenced soon after dusk and lasted till 9 p.m., when clouds and rain prevented further observations. Ten time

records were taken at intervals at Guildown, and three other local ones have been communicated to me. At times the stars fell almost continuously, and occasionally three or four at a time. As the result of actual countings of portions of the sky, the estimated general rate for all parts was found to be as follows :—

6	P.M.,	10	per minute.
7.20	,,	22	,,
7.50	,,	29	,,
8.30	,,	25	,,
9.0	,,	26	,,

A few of the observations when the shower was thickest gave 40 to 50 per minute.

Except for a short interval about 7.30, there was always cloud and mist to some degree, so that the countings and estimates are possibly under the mark. The estimated proportion of large meteors was 1 in 10. These were white with long yellow or reddish-yellow trails, and 3 to 4 times the size and brightness of Jupiter. The intermediate ones in size also were white. The smaller stars often appeared of a bluish and some of a yellow or yellow-red tint. A considerable proportion of the meteors were referred to the radiant point, but frequently they were scattered all over the sky, and not so easily traced. At intervals they seemed more numerous in particular quarters, notably E. and W., and two observers towards different points would differ considerably in their countings. The numbers observed overhead did not seem larger than elsewhere. At 9 p.m. on the 28th three large ones were observed.

J. RAND CAPRON.

Guildown, Nov 28, 1885.

To the Editor of the Meteorological Magazine.

SIR,—Last evening (November 27th) a grand display of meteors occurred here. The sky at the time had some light clouds towards the south, but these shortly cleared away, leaving it intensely clear.

At 5.45 (5.1 p.m. G.M.T.) it became suddenly alive, with meteors falling to all points of the horizon from the small star γ Andromedæ; their motion was slow, giving one the idea of flakes of snow falling in a calm. Some were very minute, barely visible; others as large as Jupiter or Venus. The latter travelled rapidly, leaving luminous red streaks in their path, lasting in some cases more than half a minute—long enough to determine their direction to the above-named star. Great numbers, and these of considerable size, but slow motion, came into view within a degree or two only of the horizon.

At 7.30 (= 6.46 p.m. G.M.T.) they diminished gradually in number. Sky clouded from 8 to 9.30 (= 7.16 to 8.46 p.m. G.M.T.), but the meteors were seen in the intervals between the clouds.

At 9.30 (= 8.46 p.m. G.M.T.) the sky was again cloudless; meteors were still falling, though less in number, on all sides.

At midnight there were only occasional ones, and these chiefly in the west.

At first, counting was quite impossible, but at 6.25 (=5.41 p.m. G.M.T.) I was able to count 104 between the N. and N.W. points in one minute; my daughter counting 60 in the opposite quarter, and another counting 39 from the radiating point in the same time.

At 10 p.m. (=9.16 p.m. G.M.T.) I counted from the radiating point 20; at 11 p.m. (=10.16 p.m. G.M.T.) 7; and at midnight (=11.16 p.m. G.M.T.) 2 meteors.

I have seen nothing like it since the shower of 1866.

Faithfully yours,

MICHAEL FOSTER WARD.

Partenkirchen, Bavaria, Nov. 28, 1885.

We have from Bavaria (12° E.) to Bristol (3° W.), and from Tunis (38° N.) to Inverary (56° N.), notes of the shower, but the prevalence of cloud renders it very difficult to determine the epoch of maximum number, and the rate of increase and decrease towards that maximum. It is quite certain that by 9 p.m. local time the numbers were decreasing everywhere. It is almost equally certain that the numbers were increasing from 5 p.m. to 6 p.m. local time. In a very interesting note in *Ciel et Terre*, the time of maximum is given for Brussels as 6 p.m. local time (5h. 43m. G.M.T.); but at Liége, within a few miles of Brussels, they are said to have been falling at the rate of 1,800 an hour at 8 p.m. local time (7h. 45m. p.m. G.M.T.) At Clermont (in Central France) the shower lasted from 6 till 9 p.m., and at 7 p.m. local (7h. 6m. G.M.T.) meteors were falling at the rate of 3,000 an hour.

In England, the observations were much interrupted by cloud, but one of the best observers (Mr. Denning, of Bristol,) found the number increase gradually from 5 till 6.35 p.m., when clouds prevented further observations. It may, therefore, be taken as certain, that at Bristol the max. did not occur before 6.30 p.m. The only report which we have yet seen from Greenwich implies a decrease from 6 p.m. onwards, but possibly full details may modify this. We think that the absolute maximum occurred at about 6.30 p.m. local time, and a very important secondary maximum between 8 and 8.10 p.m. local time.

As regards the maximum number, there is also great discordance, but three good records agree closely. M. Thirion, of Louvain, in *Ciel et Terre*, gives 193 per minute as the maximum (at 6.48 p.m. local time), counted by two observers standing back to back, *i.e.*, a total of nearly 12,000 an hour. Mr. Denning gives 5,000 an hour for *one* observer, or 10,000 an hour for two; and Col. Ward's figures also work out to about 12,000. Most records are, however, much below this, and, indeed, we are rather puzzled to know how this rapid counting is done, except where, as at our own station, a recording chronograph is available, for 5,000 an hour for one observer implies an average of $1\frac{1}{2}$ in each second, and as they do not fall uniformly, it may be said to be somewhat nearer three in one second and none in the next.

In magnitude and in their tails they were far inferior to the Leonid's of November, 1866. Very few were equal to or greater

than a first magnitude star, and not one tail remained long enough for a telescope to be turned on to it; whereas, in 1866, most of them were brighter than Sirius, and the tails were visible for minutes instead of seconds—several for 10 minutes and one for 14 minutes.

P.S. Our American contemporary, *Science*, of December 4th, reports that at George Town, D.C., Lat. 38° 55′ N., Lon. 77° 0′ W., a considerable shower was seen between 6.30 and 7.50 p.m. on 27th, [= 11.38 p.m. and 0.58 a.m. on 28th G.M.T], and four observers counted as follows:—

							a.m. 28th.					
100	between	7.0	& 7.30	=	100	between	0.8	& 0.38	G.M.T.	=	200	per hour.
100	,,	7.30	& 7.55	=	100	,,	0.38	& 1.3	,,	=	240	,,
100	,,	7.55	& 8.38	=	100	,,	1.3	& 1.46	,,	=	140	,,
28	,,	8.38	& 9.0	=	100	,,	1.46	& 2.8	,,	=	76	,,

ROYAL METEOROLOGICAL SOCIETY.

The Opening Meeting of the Session was held on Wednesday evening, the 18th November, at the Institution of Civil Engineers, 25, Great George Street, Mr. R. H. Scott, F.R.S., President, in the chair.

Messrs. F. R. H. Clunn, R. S. Davies, B.A., H. C. Fox, M.R.C.S., W. E. Jackson, J. Richardson, M.Inst.C.E., F.G.S., A. L. Rotch, and C. Todd, C.M.G., were elected fellows of the Society.

The following papers were read:—

(1). "The Helm Wind of August 19th, 1885," by William Marriott, F.R.Met.Soc. This wind is peculiar to the Cross Fell range, Cumberland, and is quite local but very destructive. The chief features of the phenomenon are the following:—On certain occasions when the wind is from some easterly point the Helm suddenly commences. At first a heavy bank of cloud rests along the Cross Fell range—at times reaching some distance down the western slopes, and at others hovering about the summit—then at a distance of one or two miles from the foot of the Fell there appears a roll of cloud suspended in mid-air and parallel with the Helm Cloud; this is the Helm Bar. A cold wind rushes down the sides of the Fell and blows violently till it reaches a spot nearly underneath the Helm Bar, where it suddenly ceases. The space between the Helm Cloud and the Bar is usually quite clear, blue sky being visible: at times, however, small portions of thin vaporous clouds are seen travelling from the Helm Cloud to the Bar. The bar does not appear to extend further west than the river Eden. The author visited the district in August last, and was fortunate enough to witness a slight Helm. He gave a detailed account of what he experienced, and also observations on the temperature of the air at the summit and base of Cross Fell, the direction and force of the wind, the movement of the clouds, &c.

(2). "The Typhoon origin of the Weather over the British Isles during the second half of October, 1882," by Henry Harries. The

author shows by means of daily charts, that a Typhoon which originated near the Phillipine Islands on September 27th, 1882, passed over Japan and the Aleutian Archipelago, entering the United States on October 10th. Crossing the Rocky Mountain range it proceeded through the Northern States and Canada to Labrador and Davis Strait. In the Atlantic it was joined on Oct. 18th by another disturbance which had come up from the Atlantic Tropics, the junction of the two being followed by a cessation of progressive movement from the 19th to the 25th. During this period the severe gale which passed along our southern counties on the morning of the 24th was formed, its sudden arrival upsetting the Meteorological Office forecasts of the previous night. Observations are quoted, showing that it would have been impossible for the Department to have been aware of its existence before about 3 a.m. of the 24th. Following in the wake of this storm the parent cyclone reached the French coast on the 27th, its advent being marked as in Japan and America by violent gales and extensive floods over the whole of Western and Central Europe and Algeria. The village of Grindelwald was destroyed, and in the Austrian Tyrol the damage caused by floods reached at least two millions sterling. Passing through France and the Netherlands the disturbance showed signs of exhaustion, and on November 1st in the Baltic it quietly dispersed, after accomplishing a journey of more than 16,000 miles in 36 days. This is the first storm which has been followed day by day from the Pacific to Europe.

(3). "Notes as to the principle and working of Jordan's Photographic Sunshine Recorder," by J. B. Jordan and F. Gaster, F.R.Met.Soc. This instrument consists of a cylindrical dark chamber, on the inside of which is placed a prepared slip of photographic paper. The direct ray of sunlight being admitted into this chamber by small apertures in the side, is received on the sensitized paper, and, travelling over it by reason of the earth's rotation, leaves a distinct trace of chemical action whenever the light is of sufficient intensity to show a definite shadow on a sun-dial. The cylinder is mounted on a stand with adjustments for latitude, &c. The record is fixed by simply immersing it in water for a few minutes. As the instrument records the actinic or chemical rays, it usually shows a longer duration of sunshine than is obtained by the ordinary "burning" sunshine recorder, the latter recording only *bright* sunshine.

[An engraving of the first pattern of this instrument will be found on p. 38 of this volume. We think that the records of this instrument should be called sun*light*, to distinguish them from those of the burning sun*shine* instrument.—ED.]

REVIEWS.

Principles of Forecasting by means of Weather Charts. By the Hon. RALPH ABERCROMBY. Issued by the authority of the Meteoro logical Council. 8vo., viii.-124 pages. London: Stanford, 1885.

BY the clearness with which he writes, and by the avoidance of technicalities and those crooked words which deter the ordinary public from following the science of the present day, Mr. Abercromby shows himself perfectly at home in the whole subject of Meteorological Chartography and weather prediction. Any one of ordinary intelligence can follow him through the whole work, and gain a clear and common sense view of the principles of weather forecasting, and to an intelligent reader the interest is greatly enhanced by the way in which it calls up in the mind many popular prognostics, and shows that they are not only true, but the practical expression of that which this work exhibits theoretically.

He has given the clearest definitions we have yet seen of anticyclones, cyclones and other depressions, and by so doing has rendered a considerable service, which we trust that future writers will utilize by rigorously following, and thus avoid the somewhat loose employment of identical terms for different conditions.

The work, which is fully illustrated, begins by describing synoptic Charts as the basis of weather forecasting, and among their data gives the Beaufort Scale, with the equivalent velocities of wind adopted by the Meteorological Office. This scale though undoubtedly very accurate in the days of sailing ships, and probably still sufficiently so at sea, gives a very rough estimate on shore, and the equivalent velocities are perhaps the most imaginary values that remain in modern Meteorology. The next chapter explains gradients, isobars and the direction of wind in relation to isobars, cyclones and typical areas of low pressure and anticyclones and typical areas of high pressure with their general accompanying weather, and it is impressed on the reader that the wind and weather depend on the shape and intensity (*i.e.*, the steepness of the gradients) of a cyclone, and not on the level of the isobars, or, in other words, on the relative and not on the absolute pressures. Having in these chapters clearly described as it were plans of the weather for given instants of time, the author proceeds with weather sequence, describing the main features of the great areas of pressure on whose arrangement the persistence of our types of weather depends. The types are described under the headings Southerly, Westerly, Northerly and Easterly, but that they are sufficiently connected with the cardinal points of the compass to justify the nomenclature, we are not fully convinced.

We are told in the preface that the Author was by illness prevented revising the proofs, and are therefore loth to criticize, but on p. 49, a misprint of Ireland for Iceland renders the meaning somewhat obscure, and the chart and descripton thereof on p. 60 do

not tally, reference being made to a reading of 31·1 in., which does not appear.

Following the "Types" comes a section on Recurrence, a few sentences of which we extract :—

"By 'recurrence' of type is meant the tendency of certain kinds of weather to recur about the same season of every year."

"January 14th to 20th, a great barometric surge. February 7th to 10th, a spell of cold weather associated with the Northerly type. This is the first of a series of six cold and three hot periods observed by Mr. A. Buchan, and described by him.* The method adopted by him was to note the irregular flexures in the general sweep of the annual temperature curve. He found their recurrence so regular that he says, 'During the last 50 years some of them appeared every 'year between the dates specified, and none failed to make their 'appearance on more than five years.'"

"April 11th to 14th, a cold spell. Buchan's second period, which he has identified with the popular 'weather saw' of the 'borrowing days.' These are three cold days which March is said to borrow from April, allowing for the difference of the old and new style of reckoning the calendar

"May 9th to 14th, a cold spell. Buchan's third period. This is the most celebrated of the cold periods, as it occurs over all Europe, and has been the subject of many wild theories. The saints to whom these days are dedicated in the German calendar have been popularly called 'the Frost Saints.' This cold spell is also known as 'Maedler's cold days,' from the name of an investigator."†

"July 12th to 15th, a warm period; Buchan's first. July 15th, St. Swithin. The popular legend of this saint, and other rainy saints like St. Méchard [? Médard], receives an easy explanation from synoptic charts. Roughly speaking, the weather at the end of July is influenced by one of two types; either the Westerly of considerable intensity, which would be rainy, or the Northerly type, which would be dry. If, then, there is either a rainy or a dry spell about the 15th, similar weather may be expected to last for some time after, if not for 40 days.

"August 2nd to 8th, a wet period; the 'Lammas floods' of Scotland. 6th to 11th, a cold period; Buchan's fifth. 12th to 15th, a hot period; Buchan's second."

The first 70 pages of the book having dealt with the *materials* for forecasting, the last 50 pages are devoted to forecasting, including storm warnings. With reference to warnings telegraphed from America, the author ventures to sum up as follows :—

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* Journal of the Scottish Meteorological Society, Vol. II. (new series), pp. 4, 41 and 107.

† For some interesting details, see W. von Bezold. "Die Kälte-rückfälle, n Mai." Abhand. K. Bayer. Akademie der Wiss., II. Cl. XIV. Bd. II. Abth.

"From all these considerations the conclusion is inevitable, that though there is an undoubted connexion between the weather on both sides of the Atlantic, the nature of the changes are so complicated and variable, that no practical use can be made of the knowledge for forecasting purposes without observations over the intervening ocean."

The section on sunspots and weather is perhaps useful in a work that is intended to be popular, though the author does not demolish the theory of their connection very vigorously; we thought that it had been long ago consigned to the limbo of fallacies.

The section on prognostics shows how useful halos, cirrus cloud, &c., may be in aiding the forecaster, especially when the indications of the synoptic charts are not clear, but recognizes the great difficulty of cirrus observations and enforces their greater value as indications of rain than of wind.

Numerous illustrations of successful and unsuccessful forecasts are given, and the reasons of their success or failure clearly shown, the effect of even a slight deviation of a cyclone from the expected track in vitiating the prediction as to direction and shift of wind is dwelt upon, and the work closes with abstracts from the summary of failures and successes worked out in the Meteorological Office which shows a percentage of complete successes of about 35 per cent., and of partial successes of about 45 per cent.

Anleitung zur Aufstellung von Wetterprognosen auf Grundlage der Zeitungs-Wetterkarten oder der Isobaren-Telegramme. Von DR. J. VAN BEBBER. (Separat-Abdruck aus der von der Deutschen Seewarte herausgegebenen Monatlichen Uebersicht der Witterung, April, 1885).

THIS paper has so much in common with Mr. Abercromby's that we add a few lines in order to call attention to it. The paper has been prepared from the Daily Weather Maps issued by the German Government during the last ten years, as Dr. van Bebber says, not in order that everybody may become his own weather prophet, but to render accessible to all the usual sequences of certain typical distributions of atmospheric pressure.

The author points out that the great difficulty in the way of weather forecasting arises from uncertainty as to the direction in which the cyclonic systems are likely to move, and gives maps and tables illustrative of the facts probable according to the localities of barometric minima, and the weather to be expected in N.W., S. and E. Germany as the result.

Mesures des Hauteurs et des Mouvements des Nuages. Par N. EKHOLM ET K. L. HAGSTROM (*Présenté à la Société Royale des Sciences d'Upsal*). 4to, 64 pages and 1 plate. Upsal: E. Berling, 1885.

M. HILDEBRANDSSON and his staff have long been convinced that the

best mode of determining the heights and motions of clouds is by trigonometrical observations made simultaneously at the extremities of a suitable base line, but the difficulty lay in the identification of the object and in the simultaneous action of the two observers. The first idea was to establish telegraph instruments at each end, but the process would have been costly and slow. When the Swedish Arctic expedition to Spitzbergen was being organized the telephone had been invented, and it was resolved to prepare special theodolites for the observation of aurora borealis, and to provide telephones so that simultaneous observations of auroral phenomena could be taken. After the return of the expedition these instruments were placed at the disposal of Dr. Hildebrandsson, and arrangements were at once made for their application to cloud measurement, Messrs. Ekholm and Hagström undertaking the work. Two brick pillars with the requisite shelter-houses were provided, one at Upsala observatory, the other at about a quarter of a mile further South.

The present work describes first the instruments, then very fully the mode of calculation, and afterwards gives the results of the summer months of 1884. We must give them very briefly.

The mean height of the various forms of cloud is given in the following table.

No. of Observations.	Cloud.	Altitude. Feet.	Miles.
5	Stratus	2050	0·4
24	Lower Nimbus	3658	0·7
12	Upper ,,	7169	1·4
101	Summit of Cumulus and Cumulo Stratus	5545	1·1
51	Base of ditto	4288	0·8
22	Lower Alto-cumulus	6522	1·2
5	Upper ,, ,,	13911	2·7
10	Cirro-cumulus	18078	3·5
64	Cirrus	22346	4·3

The altitudes of the bases of cumuli are nearly constant during the middle of the day, but increase towards evening, but the altitudes of the tops increase rapidly, from a morning minimum, until 1 p.m., when they begin to decrease, but not so fast as they had previously increased.

The bases of nimbi are often within a few hundred feet of the ground, their tops as much as 1,000 ft. above it, and though there are indications that nimbi dissolve from below upwards, the evidence is uncertain.

Cirrus clouds appear to rise throughout the day, the following being the values :—

Time	11.30 a.m.	1.30 p.m.	5 p.m.	6 p.m.
Altitude in miles	3·7	4·1	4·4	4·7
No. of observations	15	10	12	27

The authors investigate many other points, but, as they truly remark, their series of observations was too short to afford conclusive evidence. We are glad to hear that a fresh series was to be commenced with the great advantage of a longer base line than the quarter of a mile hitherto employed.

Lehrbuch der Meteorologie. Im auftrage der direktion der Deutsche Seewarte bearbeitet VON DR. A. SPRUNG. 8vo. xii,—408 pages and 17 plates. Hamburg: Hoffmann und Campe. 1885.

WE were told, not many years since, that meteorology was not a science, and as the statement was made by one who ought to be an authority, we accepted the dictum with the reverence due to the speaker's position; but a certain amount of mischief lurks in the disposition of most persons, and we certainly wish that it were our friend's fate to have to thoroughly master and be examined upon Dr. Sprung's work. We think that we should never again be told that meteorology is not a science.

The work (after an introduction explanatory of the effects of the earth's rotation, &c.), is divided into five sections, and it will give a rough idea of the character of the book if we specify the sections and the number of pages devoted to each:—(A) Statics of the Atmosphere (*53*); (B) Dynamics of the Atmosphere (*191*); (C) Solar Radiation and its periodic effects (*69*); (D) Periodic phenomena independent of either the earth's daily or annual motion (*3*); (E) Investigations into the variability of meteorological elements, independently of their cause (*16*).

The book reminds one of an experienced general who will not advance until each previous position is thoroughly safe, or like a good builder who pays special attention to the foundations, and will not allow the edifice to be advanced till all is perfectly set. Dr. Sprung, by adopting this course, creates in his readers a sentiment of solidity and of reliance which will render his book one which will last—will outlast many others. One result of this is, of course, that the work bristles with formulæ, six or seven on a page; in fact, in the section devoted to the horizontal component of atmospheric motion, there are no fewer than 50 different formulæ. We should, however, leave a false impression if we did not add that mathematical knowledge is by no means indispensable to a reader, and that no one can go through Dr. Sprung's book without having clearer and sounder views on meteorological subjects than he had before. Take, for instance, the following passage respecting the evaporation from a water surface:—

"The evaporation from a freely exposed water surface is therefore favoured by the following circumstances:—(1) High temperature; (2) Small relative humidity of the air resting upon it; (3) Motion of this air, inasmuch as thereby the collection of water molecules in a gaseous form over the liquid is avoided; (4) Small atmospheric pressure, inasmuch as with it the number of the down-pressing molecules decreases."

We are glad to see that so cautious a writer as Dr. Sprung accepts Baron Wrangel's explanation of the Bora of the Black Sea, which we cannot help thinking will afford suggestions useful to the Royal Meteorological Society's Helm Wind Committee.

Dr. Sprung's *Lehrbuch* reflects credit upon himself and upon Dr. Neumayer, Director of the Deutschen Seewarte, by whose authority it was prepared.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MAY, 1885.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute.				Average.				Absolute.		TotalRain.		Aver.
	Maximum.		Minimum.										
	Temp.	Date.	Temp.	Date.	Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	73·8	28	31·1	8	59·7	42·2	41·0	72	119·3	26·9	2·63	19	6·0
Malta	84·3	5	51·1	18	74·3	58·2	55·3	72	138·0	46·0	·00	0	2·6
Cape of Good Hope	74·0	7	34·6	31	64·5	46·3	...	...	...	...	3·73	11	5·2
Mauritius	82·6	5	64·1	27	78·7	69·4	65·3	77	131·7	50·8	7·40	17	5·2
Calcutta	103·7	26	67·2	7	96·4	76·8	74·5	71	164·7	63·0	4·84	10	3·3
Bombay	90·3	30	75·2	2	88·9	79·5	75·4	76	148·9	67·0	·02	1	1·7
Ceylon, Colombo	90·4	18	73·8	8*a*	88·3	76·0	73·5	76	147·0	64·2	9·22	24	6·7
Melbourne	75·0	2	41·2	14	61·6	48·2	46·1	73	125·0	33·0	1·23	14	7·5
Adelaide	80·6	3	42·0	7	67·7	53·7	47·0	61	138·5	38·4	2·24	16	6·7
Wellington	62·0	5	38·0	12	56·8	46·2	48·1	80	116·0	34·0	5·18	24	...
Auckland	65·5	10	40·0	31	61·8	50·6	47·9	73	124·0	30·0	4·64	19	6·7
Jamaica, Kingston	91·5	20	69·1	6	86·2	72·7	72·3	76	...	...	2·72	...	4·8
Barbados	83·0	var.	69·0	3*b*	82·0	72·0	72·5	80	149·0	...	4·32	12	6·0
Toronto	74·1	25	28·1	12	60·6	42·9	43·4	70	134·0	22·4	2·26	14	6·1
New Brunswick, Fredericton	83·2	26	24·9	4	64·9	38·1	39·1	64	...	...	2·90	8	4·3
Manitoba, Winnipeg	80·1	29	19·0	6	62·3	38·0	43·0	62	...	...	1·94	12	5·8
British Columbia, Victoria	75·0	5	36·0	1	...	...	...	...	...	...	1·30	13	...

a And 10. *b* And 19.

REMARKS, MAY, 1885.

MALTA.—Mean temp. 65°·0; mean hourly velocity of wind 8·7 miles, velocity on 5th, 31 miles per hour from 4 to 6 p.m.; sea temp. rose from 64° to 70°. J. SCOLES.

Cape of Good Hope.—Max temp. 0°·5, and min. temp. 4°·6 below average; a strong shock of earthquake at 11·40 p.m. on 10th. W. ELLERTON FRY.

Mauritius.—Rainfall 2·15 in. and mean temp. 0°·3 above average; prevailing wind E. S.E., mean hourly velocity 10·1 miles, extremes 23·9 miles on 1st, and 1·9 miles on 17th; L on 13th, T and L on 14th and 15th, T on 16th. C. MELDRUM, F.R.S.

Colombo.—TSS on 14 days, L on 15 other days. F. C. H. CLARKE, MAJOR R.A.

Melbourne.—Rainfall ·93 in., and humidity 5 below average; mean temp. of air 1°·5, of dew point 0°·1, pressure ·086 in., and amount of cloud 1·0 above average; prevailing winds N., strong on 9 days; heavy dew on 5 days.
R. L. J. ELLERY, F.R.S.

Adelaide.—Rainfall nearly an inch below average; mean temp. (60°·7) 3°·1 above average, and the highest recorded in 28 years; mean pressure (30·187 in.) ·069 in. above average; mean amount of cloud also considerably in excess, especially at 6 and 9 p.m., the means for those hours being the highest on record. W. E. COOKE.

Wellington.—A very wet month almost throughout; cold in the early part, warmer later; prevailing winds N.W. and S.E., frequently stormy and cold. Mean temp. (51°·5) 1°·5 below average; rainfall ·50 in. above average; H on 14 and 15th.
R. B. GORE.

Auckland.—On the whole a showery and unsettled month, with a predominence of S.W. wind. Pressure and rainfall above the average; mean temp. below it; heavy R on 22nd, 1·53 in. T. F. CHEESEMAN.

BARBADOS.—Rainfall 3 per cent. below average; mean temp. (76°) average; prevailing wind N.E., mean hourly velocity 12·5 miles, 13 per cent. above the average, extremes 16·2 miles and 6·2 miles; 3 days partly clouded. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, NOVEMBER, 1885.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	3·29	XI.	Rhayader, Nantgwillt..	7·65
,,	Margate, Birchington...	2·04	,,	Carno, Tybrith	5·11
,,	Littlehampton	3·19	,,	Corwen, Rhug	2·90
,,	Hailsham	3·54	,,	Port Madoc	7·71
,,	I. of W., St. Lawrence.	3·13	,,	I. of Man, Douglas	3·14
,,	Alton, Ashdell.....	3·60	XII.	Stoneykirk, Ardwell Ho.	3·22
III.	Winslow, Addington ...	4·01	,,	Melrose, Abbey Gate...	1·27
,,	Oxford, Magdalen Col...	3·51	XIII.	N. Esk Res. [Penicuick]	1·65
,,	Northampton	3·62	XIV.	Ayr, Cassillis House ...	...
,,	Cambridge, Beech Ho...	2·38	,,	Glasgow, Queen's Park.	2·49
,,	Wisbech, Bank House..	3·04	XV.	Islay, Gruinart School..	2·51
IV.	Southend	2·34	XVI.	St. Andrews, Pilmour Cot	1·67
,,	Harlow, Sheering	2·78	,,	Balquhidder, Stronvar..	5·51
,,	Rendlesham Hall	2·49	,,	Dunkeld, Inver Braan..	2·74
,,	Diss	2·81	,,	Dalnaspidal H.R.S. ...	5·21
,,	Swaffham	3·37	XVII.	Keith H.R.S.	2·64
V.	Salisbury, Alderbury...	3·78	,,	Forres H.R.S.	·93
,,	Warminster	4·19	XVIII.	Strome Ferry H.R.S....	4·88
,,	Calne, Compton Bassett	4·82	,,	Lochbroom	3·38
,,	Ashburton, Holne Vic..	8·13	,,	Tain, Springfield.....	·90
,,	Holsworthy, Clawton...	3·57	,,	Loch Shiel, Glenaladale	8·96
,,	Hatherleigh, Winsford.	4·92	,,	Invergarry	5·39
,,	Lynmouth, Glenthorne.	4·52	XIX.	Lairg H.R.S.	1·59
,,	Probus, Lamellyn	4·16	,,	Forsinard H.R.S.	3·73
,,	Wincanton, Stowell Rec.	3·59	,,	Watten H.R.S.	1·22
,,	Wells, Westbury.....	3·77	XX.	Dunmanway, Coolkelure	7·48
VI.	Bristol, Clifton	6·43	,,	Fermoy, Gas Works ...	2·27
,,	Ross	3·27	,,	Tralee, Castlemorris ...	2·23
,,	Wem, Sansaw Hall.....	3·24	,,	Tipperary, Henry Street	2·71
,,	Cheadle, The Heath Ho.	3·57	,,	Newcastle West	2·25
,,	Worcester, Diglis Lock	3·51	,,	Miltown Malbay.....	2·51
,,	Coventry, Coundon	4·00	,,	Corofin	...
VII.	Melton, Coston	2·91	XXI.	Carlow, Browne's Hill..	1·83
,,	Ketton Hall [Stamford]	3·11	,,	Navan, Balrath	2·14
,,	Horncastle, Bucknall ...	2·47	,,	Mullingar, Belvedere ...	2·57
,,	Mansfield, St. John's St	2·59	,,	Athlone, Twyford	3·30
VIII.	Macclesfield, The Park.	...	XXII.	Galway, Queen's Col....	2·88
,,	Walton-on-the-Hill.....	3·43	,,	Clifden, Kylemore	5·67
,,	Lancaster, South Road.	3·51	,,	Crossmolina, Enniscoe..	3·70
,,	Broughton-in-Furness ..	...	,,	Carrick-on-Shannon ...	1·84
IX.	Wakefield, Stanley Vic.	1·80	XXIII.	Dowra	...
,,	Ripon, Mickley	2·41	,,	Rockcorry.....	2·19
,,	Scarborough.....	1·49	,,	Warrenpoint	3·30
,,	East Layton [Darlington]	2·25	,,	Newtownards	·63
,,	Middleton, Mickleton ..	1·95	,,	Belfast, New Barnsley .	2·83
X.	Haltwhistle, Unthank..	1·69	,,	Cushendun	2·51
,,	Shap, Copy Hill	3·65	,,	Bushmills	2·15
XI.	Llanfrechfa Grange	5·79	,,	Stewartstown	2·01
,,	Llandovery	4·94	,,	Buncrana	2·56
,,	Castle Malgwyn	4·27			

NOVEMBER, 1885.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	3·31	+ ·87	·68	26	18	58·7	30	28·3	17	5	13
II.		Maidstone (Hunton Court)...	2·42	— ·48	·50	26	16	...	...	...	...	...	...
,,		Strathfield Turgiss	3·26	+ ·51	·52	26	18	58·7	3	29·0	18	6	11
III.		Hitchin	3·40	+ ·79	·39	26	19	55·0	29	23·0	17	10	...
,,		Banbury	4·14	+ 1·43	1·10	3	18	56·0	28*a*	25·0	18	6	...
IV.		Bury St. Edmunds (Culford)	2·97	+ ·14	·52	30	20	58·0	28	22·0	15	9	...
,,		Norwich (Cossey).....	2·79	— ·52	·44	3	17	58·0	28*a*	27·0	16	8	14
V.		Weymouth(LangtonHerring)	3·35	...	·65	3	15	...	...	...	...	...	...
,,		Barnstaple.....	2·81	— 1·34	·52	27	14	59·0	29	33·0	17	0	...
,,		Bodmin	4·56	— ·76	1·00	25	21	57·0	29	34·0	15*b*	0	4
VI.		Stroud (Upfield)	4·00	+ 1·06	·81	2	16	55·0	29	28·0	15*c*	...	...
,,		ChurchStretton(Woolstaston)	3·57	+ ·13	·62	27	22	55·5	29	26·0	16*d*	5	11
,,		Tenbury (Orleton)	3·24	+ ·38	·61	26	18	58·7	29	22·0	17	6	7
VII.		Leicester	2·90	...	·39	29	19	56·6	28	25·8	16	5	11
,,		Boston	3·08	+ ·71	·90	3	15	56·0	28	30·0	16	3	...
,,		Grimsby (Killingholme).....	2·24	— ·86	·47	24	16	56·0	2	32·0	6	1	...
,,		Hesley Hall [Tickhill].....	2·10	...	·71	24	17	57·0	28	23·0	17	6	...
VIII.		Manchester (Ardwick).....	2·78	— ·19	·73	27	15	57·0	3	28·0	17	5	...
IX.		Wetherby (Ribston Hall) ...	2·55	— ·21	·62	27	11	...	...	...	...	...	...
,,		Skipton (Arncliffe)	3·39	— 2·36	·97	26	17	52·0	27	26·0	16	5	...
X.		North Shields	1·92	— 1·53	·65	26	14	60·5	3	24·5	18	5	7
,,		Borrowdale (Seathwaite).....	10·35	— 1·47	3·38	26	14	54·9	3	23·5	16	5	...
XI.	WALES.	Cardiff (Ely).....	5·70	+ 1·50	1·06	27	13	...	...	...	...	...	...
,,		Haverfordwest	4·31	— 1·03	1·08	26	10	55·0	2, 3	28·0	15*c*	6	9
,,		Plinlimmon (Cwmsymlog) ...	7·15	...	2·18	2	15	...	...	...	...	...	...
,,		Llandudno.....	2·54	— 1·37	·60	27	11	58·8	3	31·0	15	2	...
XII.	SCOTLAND.	Cargen [Dumfries]	2·94	— ·97	1·11	26	14	54·0	3, 4	20·0	18	10	...
,,		Jedburgh (Sunnyside).....	·99	— 2·02	·40	26	10	57·0	3	17·0	18	12	...
XIV.		Douglas Castle (Newmains)	2·66	— ·89	1·21	26	11	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	4·32	— 1·04	·90	26	14	...	...	...	..	...	...
,,		Oban (Craigvarren)	4·44	...	·75	3	15	56·4	4	25·0	18	5	...
,,		Mull (Quinish).....	3·78	...	1·48	2	15	...	...	...	...	...	...
XVI.		Loch Leven Sluices	2·60	— ·95	·60	27	10	...	...	...	...	...	...
,,		Arbroath	1·77	— 1·38	·64	26	13	56·0	3	22·0	18	6	...
XVII.		Braemar	3·82	+ ·05	2·02	26	13	58·0	3	9·5	18	13	22
,,		Aberdeen	2·07	...	·55	26	17	59·0	2	18·0	17	11	...
XVIII		Skye (Sligachan)	...	...	...	...	...	...	...	...	...	...	...
,,		Culloden	7·20	— 1·98	...	...	...	59·0	3	23·0	16	11	21
XIX.		Dunrobin	...	...	...	...	...	...	...	...	...	...	...
,,		Orkney (Sandwick).....	2·07	— 1·37	·42	6	14	57·7	3	29·5	14	3	...
XX.	IRELAND.	Cork (Blackrock).....	3·76	— ·85	·93	25	21	59·0	29	29·0	...	2	...
,,		Dromore Castle	6·23	...	1·00	1	16	58·0	16	30·0	14	...	...
,,		Waterford (Brook Lodge) ...	3·73	...	1·39	25	18	54·5	29	27·5	15	1	9
,,		Killaloe	2·50	...	·36	4	15	54·0	2	27·0	15	6	...
XXI.		Portarlington	1·56	— ·84	·30	25	19	59·0	4	28·0	14	4	...
,,		Dublin (FitzWilliam Square)	2·40	— ·12	·88	26	17	62·1	3	31·0	15	1	10
XXII.		Ballinasloe	2·24	— ·76	·44	2	16	54·0	2, 7	23·0	15	6	...
XXIII		Waringstown	1·64	— 1·07	·70	26	11	60·0	3	21·0	14	7	10
,,		Londonderry (Creggan Res.).	2·63	...	·57	4	18	...	...	...	...	...	...
,,		Omagh (Edenfel)	2·64	— ·41	·53	25	16	57·0	28	28·0	16	6	..

a And 29. *b* And 16. *c* And 17. *d* And 18.

+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON NOVEMBER.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The cold frosty weather of the middle of the month, assisted materially by intermittent fresh winds from the E.N.E, afforded excellent opportunity for wheat sowing.

BANBURY.—Very heavy R fell on 3rd, causing floods, followed by a fortnight of cold weather, tolerably dry but misty; the last week was wet and milder. Mean temp. (42°·7) slightly above the average. Fog on 3 days, wet mist on 5, high wind on 2.

CULFORD.—A very wet month, with occasional frosts and wind, and but little sunshine.

LANGTON HERRING.—Rainfall ·29 in. and mean temp. slightly, below the average. From 6th to 12th there was scarcely any variation of pressure or of temp., and very little sunshine, the prevailing wind being N.E. Fog on 21st and 22nd.

BODMIN.—A very mild November; mean temp. 46°·1.

WOOLSTASTON.—R and fog prevailed during the greater part of the month; mean temp. 40°·3.

ORLETON.—The first half of the month was cloudy and gloomy with an average temp. and not much R; from the 15th to the 19th severe frost occurred every morning with a dry cold wind; the remainder of the month was very stormy with heavy falls of R and little sunshine. The fluctuations of pressure during the month were great and frequent; on the 28th and 29th the rivers Teme and Severn were much flooded. Mean temp. about 0°·7 above the average.

LEICESTER.—A dull and dreary month, mist and fog prevailing almost every day; there were a few sharp frosts; H on 27th.

KILLINGHOLME.—The weather was very unsettled but not severe; there was a good deal of strong wind, but no gale to do damage.

MANCHESTER.—A fairly seasonable month, though without much frost; the weather generally was dull, but there were a few days of bright sunshine.

NORTH SHIELDS.—Fog on seven days, S on one only.

SEATHWAITE.—There was a long spell of dry weather in the middle of the month, but on the three days, 2nd to 4th, 3·66 in. of R fell, and on the 26th and 27th, 5·11 in.

WALES.

HAVERFORDWEST.—The month commenced, wet; very dark, calm weather with rather low temp. set in on the 9th, and continued to the 13th, when R fell; from 14th to 25th was very cold with keen easterly winds and a very wet stormy period closed the month. One of the most unfortunate Autumns remembered. Some barley could not be taken in until the fine calm weather between the 14th and 25th; dense fog on 29th.

LLANDUDNO.—A dull November, though exempt from storms; polar winds chiefly prevailed from 8th to 25th. Mean temp. and range of temp. both slightly below the average. H on 5th and 14th.

SCOTLAND.

CARGEN.—A remarkably dull and gloomy month, with only 32 hours of sunshine, the average being 92 hours; mean temp. 0°·6 below average.

JEDBURGH.—Rainfall smaller than in any November of the previous 20 years, and springs all over the district were never before known to be so low. The

first three weeks were marked by great stillness of the atmosphere, and little or no sunshine. Primroses were in bloom on 10th.

OBAN.—A very fine month, and an early arrival of frost without being followed by the usual stormy sequence is the feature in this district. S on 5th and 13th; H on 5th and 27th; first frost on 13th; very fine aurora on 18th, heavy gale on 27th.

QUINISH.—The first week was wet and stormy, the remainder of the month very fine.

ABERDEEN.—Rainfall considerably below the average; aurora seen on 5th; S and sleet on 14th; lunar corona on 15th.

CULLODEN.—An unusually dry month, frost prevailing more or less throughout.

IRELAND.

WATERFORD.—A very mild month, rainfall about the average; there were ripe strawberries in the garden on 16th.

KILLALOE.—A fine open month, with moderate rainfall and mild temp.

DUBLIN.—A mild, very dull month, S.E. and E. winds preponderating to a remarkable extent; the rainfall was very small up to 21st, but a stormy rainy period followed, lasting nearly to the close. The month was very mild (mean temp. 45°·1), but not so mild as November, 1881 (49°·4) which was by far the warmest November in 20 years. November was also warmer in 1866 (45°·4), and in 1874 (45°·8) than in the present year. There was actually an increase of temp. from October to November. H on 15th, sleet on 4th, lunar corona on 21st, fog on 6 days. Mean temp. 1°·4 above the average; mean humidity 88; mean amount of cloud 6·7; prevailing winds S.E. and E.

WARINGSTOWN.—A wonderfully dry and fine month.

EDENFEL.—The first and last weeks were wet and unsettled; the intermediate fortnight was calm and fine, and occasionally clear and frosty; the number of rainy days was considerably less than the average.

EARLY RECORDS OF FROST.

To the Editor of the Meteorological Magazine.

SIR,—In Burton's "Chronology of Stamford" I find that "a very severe frost commenced in October, 760, and continued to February, 761. Also another from the beginning of November, 1076, to April, 1077. In November, 1844, a frost set in and continued with very little intermission until April, 1845; the greatest degree of cold was on Friday morning, the 14th of March."—I am, Sir, yours faithfully,

FRED. COVENTRY.

Ketton Hall, Stamford, June 2nd, 1885.